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Proceedings of the Maritimes Regional Advisory Process Stock Assessment Update of SPAs 1,3,4,5 and 6 Scallop Stocks

24-25 November 2005

Park Place Hotel & Conference Centre (Ramada Plaza)
Dartmouth, Nova Scotia

Ross Claytor (Chair)

Réunion du Processus consultatif régional des provinces Maritimes Mise à jour des évaluations des stocks de pétoncle des APP 1,3,4,5 et 6

24-25 Novembre 2005

Park Place Hotel & Conference Centre (Ramada Plaza)
Dartmouth (Nouvelle-Écosse)

Ross Claytor (président)

Fisheries and Oceans Canada / Pêches et Océans Canada
Bedford Institute of Oceanography / Institute océanographique de Bedford
Dartmouth, Nova Scotia / Dartmouth, N.-É.
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Foreword

The purpose of these proceedings is to archive the activities and discussions of the meeting, including research recommendations, uncertainties, and to provide a place to formally archive official minority opinions. As such, interpretations and opinions presented in this report may be factually incorrect or mis-leading, but are included to record as faithfully as possible what transpired at the meeting. No statements are to be taken as reflecting the consensus of the meeting unless they are clearly identified as such. Moreover, additional information and further review may result in a change of decision where tentative agreement had been reached.

Avant-propos

Le présent compte rendu fait état des activités et des discussions qui ont eu lieu à la réunion, notamment en ce qui concerne les recommandations de recherche et les incertitudes; il sert aussi à consigner en bonne et due forme les opinions minoritaires officielles. Les interprétations et opinions qui y sont présentées peuvent être incorrectes sur le plan des faits ou trompeuses, mais elles sont intégrées au document pour que celui-ci reflète le plus fidèlement possible ce qui s'est dit à la réunion. Aucune déclaration ne doit être considérée comme une expression du consensus des participants, sauf s'il est clairement indiqué qu'elle l'est effectivement. En outre, des renseignements supplémentaires et un plus ample examen peuvent avoir pour effet de modifier une décision qui avait fait l'objet d'un accord préliminaire.

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ABSTRACT

These proceedings record discussions that were held during the Regional Advisory Process (RAP) meetings for the Bay of Fundy scallop stocks on 24 and 25 November 2005.

RÉSUMÉ

Le présent compte rendu relate les discussions qui ont eu lieu lors des réunions sur les stocks de pétoncle de la baie de Fundy tenues dans le cadre du Processus consultatif régional (PCR) les 24 et 25 novembre 2005.

INTRODUCTION

The chair, Ross Claytor of the DFO, opened the meeting for the SPA 1,3, 4, 5, and 6 Scallop Stocks. The remit was identified as:

Area 1 Scallop:

- Assess the status of Area 1 scallop. The assessment should include:
  - An analysis of available commercial and survey information since 1981
  - Application of the assessment model used in CSAS research document 2003/010.
- Review advice provided for the 8-16 mile Digby area for Full Bay fleet and provide advice for rest of area for the 2005/2006 fishery.
- Produce a section of the Inshore Scallop Science Advisory Report documenting the results of this assessment.

Area 3 Scallop:

- Assess the status of Area 3 scallop. The assessment should include:
  - An analysis of available commercial and survey information
- Provide advice for the 2006 fishery
- Produce a section of the Inshore Scallop Science Advisory Report documenting the results of this assessment.

Area 4 Scallop:

- Assess the status of Area 4 scallop. The assessment should include:
  - An analysis of available commercial and survey information
  - Application of the assessment model used in CSAS research document 2003/010.
- An analysis of available commercial and survey information since 1981
- Application of the assessment model used in CSAS research document 2003/010.

Area 5 Scallop:

- Assess the status of Area 5 scallop. The assessment should include:
  - An analysis of available commercial and survey information
- Provide advice for the 2006 fishery
- Produce a section of the Inshore Scallop Science Advisory Report documenting the results of this assessment.

Area 6 Scallop:

- Assess the status of Area 6 scallop. The assessment should include:
  - An analysis of available commercial and survey information since 1997.
- Provide advice for the 2006 fishery
- Produce a section of the Inshore Scallop Science Advisory Report documenting the results of this assessment.

Decision Rule Discussion:

The difficulty of providing scientific advice in terms of the setting of TACs without having decision rules and reference points has been identified as a serious issue in previous Stock

Status Reports for these management areas. Time will be allocated during this meeting to discuss candidates for these rules and reference points.

The following working papers were provided as supporting documentation for satisfying the remit.

1. SPA 1 - Inner/Upper Bay of Fundy by Dale Roddick
2. SPA 1: 8 – 16 mile zone by S.J. Smith, M. Lundy, and S. Rowe.
3. SPA 3 by S.J. Smith, M. Lundy, and S. Rowe.
4. SPA 4: Digby by S.J. Smith, M. Lundy, and S. Rowe.
5. SPA 5: Annapolis by S.J. Smith, M. Lundy, and S. Rowe.
6. SPA 6 – Grand Manan and Southeast New Brunswick by Dale Roddick

Stephen Smith made a presentation, without working paper, on the Decision Rule approach to managing this fishery.

External reviewers, John Tremblay and Jae Choi, provided initial Comment on the working paper and presentation and the chair opened the meeting to the floor for additional Comment. Comments were received by section of the working paper.

Upon the completion of the review of the working paper, the stock assessment report (SAR) was reviewed.

SUMMARY OF CONCLUSIONS AND DISCUSSION OF WORKING PAPERS REVIEW (IN ORDER OF PRESENTATION)

SPA 4:

Conclusions:

- Landings in 2004/2005 were 535 t against a TAC of 550 t. An interim TAC of 200 t has been set for the 2005/2006 season which opened 1 October 2005.
- Commercial catch rates in 2004/2005 (21.8 kg/h) declined from 2003/2004 (38.6 kg/h) and were near the median over the whole time-series (21.3 kg/h). Mean catch rates in October 2005 (12.2 kg/h) are less than half the mean for October 2004 (27.0 kg/h).
- Survey numbers indicate that the stronger than average 1998 year-class has been fished down and there are no indications of any substantial recruitment for the next two to three years.
- The population model predicts that the current TAC of 200 t will result in a median exploitation rate of 0.26 and a decline in population biomass.
- A fishing strategy of 150 t in 2005/2006 and in 2006/2007 has a 0.50 probability of resulting in exploitation rates at or below 0.2 which could allow the population biomass to increase slightly.

Comment and Questions:

Landings, Catch Rates and Meat Weight Samples

Scientific Reviewers:

Comment: Maps of average size to indicate the spatial distribution in meat weights would be useful. It is noted that smaller meat weights occur towards deeper water, what does this mean?
Answer: Depth is a key indicator that reflects food availability.

Participant Reviewers:

Comment: Catch weights in April 2005 were slightly higher than in Oct.
Answer: October weights resemble April weights because meats are just recovering from spawning. October usually has the low weights because scallops are recovering from spawning. In April, scallops are recovering from winter. Slow recovery in October may be related to plankton growth which was down this year.
Comment: There was some effect on October CPUE from bad weather because of wind. What effect in terms of growth does water temperature have?
Answer: Water temperature this year was cooler compared to previous years. Temperature does not have a strong effect in Area 4 because it mixes well. Food and temperature are related and food availability fluctuations are the most important.
Comment: Does water temperature trigger spawning?
Answer: A drop in temperature has a bigger effect. Success is not related to level. It is food related because poor growth means poor fecundity.

Survey and Numbers

Scientific Reviewers:

Comment: Change in vessels and timing of vessels are two important issues.
Answer: There was bi-monthly sampling to collect data on the change in meat weight and shell height. These data were used to grow the scallops in the population model from June to August in 2004. This was not necessary for 2005 as the survey was conducted in August.
Answer: With respect to vessel change and spatial distribution the concentrations were found in the same areas in 2005 as in 2004. This adds to the level of confidence that the Royal Fundy results are comparable to the Hart.
Comment: How do changes in effort affect Fig. 11? Is a unit of fishing effort the same now as 10 years ago? Has bottom mapping made a difference in fishing location. CPUE might be more efficient.
Answer: The fishing gear is the same and navigation improvements came in many years before the relationship in fig. 11 was started. In the late 70s and early 80s there were minor changes made to the gear, but for the most part the gear is the same as in the 30s and 40s. Navigation improvements have not had an appreciable effect on fishing. No bottom mapping in Bay of Fundy.
Comment: Fig. 11 seems to indicate that the research survey is redundant.
Answer: The survey provides recruitment information which commercial gear does not.
Comment: The distribution of clappers indicates that natural mortality is low and that there is a high F.

Answer: A large number of clappers would indicate a higher M. If there is not a large number of clappers then F would be thought to be higher. Molluscs tend to have low M, except where drastic temperature changes occur. In the Bay of Fundy there is a low background M and incidents of high M are episodic. The lifespan of a scallop can be as much as 18 years. Meat weights tend to go down by 6-7% because of gonads as scallops prepare for spawning.

Participants:

Comment: What are the differences between lined and unlined gear?
Answer: Lined fills up quicker than unlined and changes the efficiency.
Comment: Survey seems to provide a good indication of stock except when there is a large biomass.
Answer: This applies only to model and recruits for years of big increases. We overestimate numbers because the gear is less efficient when abundance is high.

Population Model

Scientific Reviewers:

Comment: Why does the predicted and estimated pattern change?
Answer: Increased growth has been documented in earlier assessments. Part of the differences observed are occurring because of these differences in growth over time. Part of the differences are because of changes in catchability.
Comment: Is spatial difference an aspect to this differentiation.
Answer: Areas tend to go up and down together. A spatial growth model is incorporated so that survey sampling does not bias results.
Comment: Were you surprised by the convergence of estimated and predicted?
Answer: In a low population regime, gear is more consistent in performance so catchability is not as much a factor.
Comment: Error bounds need to be added to determine if differences are significant.
Answer: Distributions tend to be skewed and a flat prior distribution for catchability is assumed. A histogram of error could be presented but it is difficult to follow. The variability is brought through to the advice in the end.
Comment: Could fisheries CPUE be added as an additional index to reduce uncertainty. How about other methods such as geostatistics?
Answer: Spatial growth is useful, but not for abundance. There are differences in fishermen CPUE and it is not clear how to take this into account.

Harvest Advice

Scientific Reviewers:

Comment: 150t is reported as likely that F=0.2 will not be exceeded. Is there a way to empirically measure the result.
Comment: What are the most important factors in affecting advice?
Answer: Most parameters in the Bayesian population model have uninformative priors so that the data can have as much influence as possible on the posterior estimates. The posterior probabilities are used in the decision rules so all of the uncertainty can come into play. Changes in growth and catchability do contribute to the variability in the population estimates and advice. Temperature and primary productivity could explain past changes in growth but would be difficult to incorporate into forecasts.

Comment: What is the relationship between recruitment and adults in an area?
Answer: Larvae in areas seem to be genetically similar to adults.

SPA 1A:

Conclusions:

- Landings were 322 t against a TAC of 400 t for the 2004/2005 season.
- Commercial catch rates have been declining from the peak in 2002.
- Survey estimates indicate that the larger than average 1998 year-class has been fished down with no strong year-classes evident in the survey size frequencies for upcoming years.
- A fishing strategy of 100 t in SPA 1A for 2005/2006 and 2006/2007 will likely result in median exploitation rates (0.18 and 0.18) at or below 0.2 which could allow the population biomass to increase slightly.

SPA 1B:

Conclusions:

- Landings were 228 t against a TAC of 200 for the Full Bay Fleet 2005/2006 season, and 206 t against a TAC of 200 for the Mid and Upper Bay fleets 2005 season.
- Commercial catch rate has declined the last two years, but is still above the median level.
- Survey estimates indicate there are two above average pre-recruit year-classes, however the pre-recruit year-class that appeared above average last year appears about average this year. The advice is to maintain the present quota until the contribution of these year-classes is better defined.

8 -16 Mile Zone

Comment and questions:

Landings, CPUE, and Meat Weights

Scientific Reviewers:

Comment: Use actual numbers for percentile reports.
Answer: The actual numbers can be added to the legend.
Comment: Is this one unit? If so why is the analysis broken down into areas?
Answer: The system is large and is treated as one large unit. There are different time series for different parts of the bay and survey distribution differs over the years. So the survey analysis is broken down into units with consistent coverage.
Comment: There is no effort information.
Answer: Effort could be presented.
Comment: What is meat weight used for? Is there a problem with small scallops? Look at the landings of small size class.
Answer: Distribution of small scallops describes where the recruitment is occurring, and the meat weight sampling shows if recruiting year-classes are being targeted by the fishery.

Participants:

Comment: The Bay should be treated as one area rather than many sub-areas.

Surveys

Scientific Reviewers:

Comment: Mode for size frequencies is smaller in 2004 than in 2005. Recruitment modes cannot be followed so caution in interpretation is required.
Comment: One of the primary predators is starfish, is there any information on abundance of starfish. Other predators might be skates, sea urchins, and hagfish.
Answer: Starfish are not tracked in the survey only commercial groundfish and lobster bycatch are routinely recorded.. Monitoring these would require an additional person on board. Only 6 – 8 tows occur on the groundfish survey in this area and so that survey is of limited use.
Comment: How do survey tows and area compare to past.
Answer: There were more tows in the survey and some area expansion.

Participants:

Comment: Some groundfish eat smaller sized scallops, monkfish eat small scallops.
Comment: Use of the commercial vessel (for survey?) was useful.

SPA 1 – Split into Smaller Areas

An analysis was presented that looked at the possibility of providing advice for SPA 1 by sub-areas.

Scientific Reviewers:

Comment: Survey needs to be expanded. If there is a split to smaller areas then the only independent source of data will be surveys. The level this year was good, but it is not always so. Towcam may be useful for groundtruthing densities.
Comment: The splitting seems to be a good first attempt, but it is premature for use.
Comment: Small areas were not surveyed. CPUE could be used but some calibrations would be required. A survey would take area into account.
Comment: There may be a problem with the length of the time – series.
Comment: There is 15 years between peaks so need to span that interval.

Participants:

Comment: In other areas the CPUE seems to be aligned with survey estimates. CPUE could be used as a proxy until the survey is expanded or an alternative method of management is developed.
Comment: Total biomass of BCD is not calculated.

SPA 3:

Conclusions:

- Landings in 2005 were 208 t against a TAC of 200 t. An interim TAC of 50 t was set for the 2005/2006 season and unlike recent years fishing occurred in October in 2005.
- Commercial catch rates averaged 16.7 kg/h in 2005, compared to 22.1 kg/h in 2004 and were just above the median catch rate for the series (14.5 kg/h).
- The 2005 survey index (1.4 kg/tow) indicated that the biomass of commercial size scallops declined after 2002, but remains just above the median (1.3 kg/tow) for the ten-year survey series.
- There appears to be little sign of recruitment for 2006.
- Based upon the survey trends, the population appears to be stable at the 150 to 200 t catch level with the possibility of an above average 2004 year-class that could recruit to the fishery within St. Mary's Bay in 2008.

Comment and Questions:

Landings, CPUE, and Meat Weights

Scientific Reviewers:

Comment: Digby is good but little effort is in Lurcher, catch and effort are up but CPUE is down.
Comment: Standard errors and 95% confidence intervals need to be carried over from design. Does any of the error come from average size calculation.
Answer: Error is all from survey design.

Participants:

Comment: In 2003 the CPUE was from a concentrated area. 2005 is similar to the long-term average.
Answer: 2005 was average and the biomass index showed a slight increase over time. With little fishing the scallops are larger.

Surveys

Scientific Reviewers:

Comment: Multiple maps to follow patches would be useful. Recruitment patches seem to vary. Large recruitment pulses in one year but do not survive. Deep water has low sampling intensity and recruitment is very local.
Comment: There is difficulty following recruitment.
Answer: Recruitment is very localized and the prerecruits often don't survive because the areas they are usually found are very deep and food is poor. Growth rates are lower in the west and fishermen usually can't fish at regulation count. Yield fluctuates 30% for same size animals and there is low quality.

Participants:

Comment: St. Mary's Bay looks more promising. With respect to lobster by-catch, survey by-catch is available.

Outlook

Scientific Participants:

Comment: Population seems stable at this catch level, but 2002 only 31 t were removed. Survey index dropped in 2003. Survey was done in August after fishery so timing is an important aspect.
Comment: Clappers seem to be in high density. What would high concentrations of clappers look like in these maps?
Answer: Bay of Fundy in the late 80s sets the standard for bad events and high concentrations of clappers. Clappers only exist in high concentrations in episodic events. We are keeping an eye out for episodic events. F is high because there are few clappers. Long-term historical values have been about 2 – 4%.

Participants:

Comment: What is required to establish reference points? Are they beneficial in this case?
Answer: A model based indicator and projection is required. There are two kinds of reference points, biomass and F. Relative indices might be most appropriate.
Comment: Clappers tend to be in deeper water and low growth areas.

SPA 6:

Conclusions:

- Landings to 7 November 2005 were 83 t against a TAC of 195 t.
- Landings have been in the range of 80-90 t per year for the last three years under a TAC of 195 t.
- Commercial catch rates for the Full Bay fleet have been fluctuating with low effort. CPUE for the Mid Bay Fleet is fluctuating at a lower rate at or above the 1993-2005 median level.
- Effort has decreased by 57% over the last 7 years and is below the median level.
- Due to vessel problems, there was no DFO survey in SPA 6 in 2004. A survey with a commercial vessel in 2005 only covered part of SPA 6B due to time constraints.
- Most of the stock indicators show no signs of good recruitment, and a stock of fully recruited scallops that is being fished down.
- The advice is that the catch should not exceed 80 t in 2006.

Comment and Questions:

Landings, CPUE, and Meat Weights

Scientific Reviewers:

Comment: Why is there a difference in Full Bay and Mid-Bay CPUE?
Answer: Very few Full Bay vessels are fishing there and there has been a drop in effort by the Mid Bay fleet. 5 Full Bay boats fish there and bad weather will reduce effort. A

change in regulations makes it unattractive for the Full Bay to go to Area 6. Mid Bay lobster fishing looks good and lobster boats have less financial reason to also fish for scallops.

Comment: Abundance seems to be too low to meet the TAC.

Answer: Combination of abundance and low effort keeps the TAC from being met.

Participants:

Comment: There used to be more boats in this fishery.

Survey

Scientific Reviewers:

Comment: The stock seems to be over-exploited based on size changes. Small size is not due to a recruitment pulse. Is there a record of meat size? 83 tonnes seems too high. Surveys being constant seems to balance CPUE fluctuating.

Comment: Year-class seems variable, recruitment is going down. Commercial size is maintained but should decline as recruitment is low. Landings are primarily effort driven.

Answer: Only 88 tonnes landed in SPA 6.

Comment: Survey has small sample size. Can estimate biomass only within specific spatial bounds.

Comment: Based on size composition of meats and lack of recruitment 80 -90 tonnes seems too much. This is evidence of growth over-fishing.

Answer: The numbers of large meats in the samples indicate that effort is not so high that the population of older scallops is being fished out. The numbers of small scallops in the catch show that with the low overall abundance, patches of recruiting year-classes are targeted as soon as they reach commercial size. Recruitment is currently low and so this situation will not change unless it improves.

Answer: We will return to this fishery tomorrow to resolve some of these issues.

Comment: Use of historical survey data would be useful.

On the Second Day Returned to SPA 6:

A decision on the status of the resource was difficult to make because there was no survey in 2004 and a survey with a commercial vessel covered only part of SPA6B. Therefore, it was decided to turn to a list of positives and negatives to provide advice.

Positive Trends:

It was noted that there were more 140+ mm size animals escaping the fishery than in other SPAs.

Negative Trends:

It was noted that there had been no change in recruits from additional survey stations that were not originally included in the analysis.

Meat weight data shows small scallop suggesting higher F unless recruitment is increasing, which did not seem to be the case.

A suggestion for the future was to break samples down by fleet to see if the different fishing locations and patterns of the fleets were impacting the stock differently.

SPA 5:

Conclusions:

- Landings in 2005 were 13.3 t against a TAC of 10 t.
- Commercial catch rate in 2005 (26.1 kg/h) was lower than in 2004 (32.1 kg/h) but still above the median for the 1977 to 2005 series (21.0 kg/h).
- Survey estimates indicate that the commercial size portion of the population (126/tow) is just above the median (123/tow) but little recruitment is expected for the next two years.
- The TAC for 2006 should not exceed the average over the low abundance periods (1997 to 1999) of 10 t.

Landings, CPUE, and Meat Weights

Comment: none

Survey

Scientific Reviewers:

Comment: What are white polygons on Fig. 3.
Answer: No meaning.
Comment: The southern most bound does not include the lowest abundance areas.
Answer: This contour is a sand bar of 1 –2 fathoms.

The group agreed that it was worthwhile having a separate assessment for SPA 5 even though it was small.

Conclusions Reached that Applied to all SPAs

- Objectives and associated reference points are beginning to be developed for these fisheries. Discussions between the fishing industry and DFO to develop reference points for the scallop fisheries in the Bay of Fundy need to be continued.
- In order to maximize yield-per-recruit, the impact of fishing practices on the mortality of recruits and pre-recruit scallops needs to be investigated.
- Implement research and monitoring to establish the relationship between scallop biomass and future recruitment success.
- Implement research and monitoring to determine the conditions leading to episodic die-offs.

SFA 29

- No advice was available for this area at this time. A formal stock assessment will be presented in 2006

SPA 2

- This area is considered to be marginal for scallop habitat.

- There is no scientific advice available for this area.

Decision Rule Discussion

Stephen Smith made a presentation, authored by S.J. Smith, M.J. Lundy, S. Rowe, and D. Roddick, entitled: 'Reference points and decision rules'. He indicated the decision rule process had three components, (1) an indicator, (2) a reference point, and (3) the decision rule.

Examples of indicators are: estimated population biomass, commercial catch rate, and exploitation rate. There are two kinds of reference points: (1) Limit or threshold such as minimum biomass and maximum exploitation and (2) Target, such as biomass at MSY or fishing mortality at MSY. A decision table was provided as an example of how decision rules could be developed for evaluating future catches.

The elements presented as they would apply to Bay of Fundy scallops were:

1. Choose an indicator
2. Set a reference point
3. Set an acceptable probability of passing the reference point
4. Set an action in place when probability of passing the reference point is higher than acceptable.

Discussion Points and Questions:

Are we limited to one reference point? Would there be separate decision rules and reference points in boom and bust periods.

It would be better to be proactive in the development of decision rules rather than let someone from outside the fishery impose them. This would require a special session. In particular, it would be important to have the answers to such questions as, what would have been the advice if this system had been in place in previous years. The overall strategy needs to be developed. For example, what do we do in areas where we cannot do this. From this would come a comprehensive plan that minimizes economic disruption and provides a roadmap for the next few years.

Simulations would be used to provide the answers to these questions.

The probability density distribution needs to be included. The sensitivity to other parameters needs to be explored. The empirical distribution could be used to provide probabilities of exceeding reference points.

Follow up would be necessary to evaluate the effects of any decisions. Especially initially, when we might run the new and old systems in parallel.

Objectives and OBFM fits into this. The question becomes how do we stay normal?

Written comments from reviewers are provided below:

Reviewer #1

Comments on Scallop Assessment Documents - RAP of 24-25 November 2005

Overall

The assessment for SPA 4 in particular is at a high level and is an excellent model for other assessments. The decision tables provided should be very useful for Fisheries Management and industry.

It would be helpful to have an overview of all areas (single table or figure?) showing trends. With the overlapping fishing zones and fleets and the differences in data available it is easy to lose the forest for the trees. These SPAs likely comprise two stocks at most.

Maps of previous years would be very helpful for viewing changes in spatial distribution of all sizes and of for prerecruits in particular. Mention is made in several of the documents of pre-recruit modes that disappear. In the same documents there are predictions made about when certain pre-recruit modes will enter the fishery. Maps would help in evaluating the spatial extent of such modes and whether they are likely real. Annual maps would also help in assessing the reliability of surveys where the areal extent has not been consistent (e.g. SPA 6). The maps can be made small without too much loss in resolution (snow crab docs. have provided multiple maps of survey distribution on single page).

SPA 4 – Digby

p. 1 -3
4. survey numbers

- Change from June to Sept (04) survey date...how was bimonthly sampling program used to adjust? Presumably for growth. Provide more detail

- Re vessel change – assumption of no effect made. Could this be checked by examining spatial trends over years? i.e. were high density patches (of whatever size) apparent over a number of years when Hart was in use? Any continuity apparent when looking at 2004 compared with 2005 (new vessel)? Some suggestion of this in bullet 4c.

Regarding Efficiency of effort...no increase in fishery efficiency in the last 10 years or so due to changes in boat size, navigational aids etc? Relationship between cpue & biomass index (Fig. 11) would suggest not...would expect cpues in more recent years to be above line if this was the case.

Fig. 12 – predictions from year t-1 underestimated biomass 2001-2004. Text p.3 6b indicates due to "changing growth rates observed during period". But also due to changing catchability in lined relative to unlined gear? Any data to present here? Assume they grew faster than expected? What might cause these changes in growth ...temperature or phytoplankton production?

Is it possible that spatial variation in growth could cause some of the apparent annual growth differences?

Fig formats - Fig.6 – Assume this is no. per standard tow...label y-axis please

SPA 1 – Inner/Upper Bay of Fundy

Fishery –
No effort information provided here? Please provide

Survey results

- Need to illustrate survey areas on a map e.g. Cape Spencer grounds; Upper Bay area [are labelled on map provided in SAR, include this in Res Doc.]
- i.e. reduction in apparent abundance of small scallops from one year to next...Upper Bay in 2004 vs 2005: any evidence of clappers? Sampling variability? Suggest softening (even further) the statement about two modes seen in Upper Bay in 2005 and when they should recruit to the fishery.

Outlook
3rd paragraph - Clarify what is meant by expansion in survey required. Assume talking about spatial extent, but survey appears to include all of areas fished. Station density appears similar to SPA 4. Regarding independent estimates of biomass--- from video surveys? Would SPA 4 also benefit from independent estimates? This paragraph in the Outlook is also used for SPA 6 which seems to have less consistent coverage.

SPA 3 – Brier, Lurcher, St. Mary's Bay

Fig. 4f – size frequencies off Brier Lurcher – Another missing pulse of pre-recruits. What was spatial extent? Would be helpful to show surveys from previous years (several per page).

Figs of spatial distribution – show units (assume no. per std tow)

Re stability at 150-200 t...seems population dropped substantially from 2002-2003 with only 31 t removed. Clarify landings during period.

Reviewer #2

What follows are:

1. general comments
2. area-specific comments, and
3. some research recommendations stemming from the discussions at the RAP and reading of the working papers.

General Comments

Data sources were spatially extensive and intensive with generally very complete coverage by the research survey in the Bay of Fundy. The data analysis and assessments were of high calibre. The biomass and catch rate estimation and prediction procedures seem to be functioning extremely (impressively) well. Even though the authors did note some deviations due to previously unaccounted factors, deviations were minimal when placed in context with the reality of the confidence limits associated with the data and predictions. Regardless, the discordance allowed the rapid detection of potential causes of the divergence (growth changes) that were quickly adapted into a new model. These are all indicative of an assessment process that seems to definitely be on track.

Beyond the assessment itself, steps were made towards the identification and provision of risk estimates based upon projections of the probability density distributions derived from the

predictive population dynamic model. Examples of its use were identified, the ramifications of which are likely to be quite extraordinary. I look forward to seeing such an approach being adopted in other fisheries where possible.

Being a novice to the assessment of scallops, various (simple) methodological clarifications were required as the working documents generally referenced previous documents. Some threshold level of methodological description (brief statements of sampling design and structure, biomass estimation procedure) would nonetheless have been helpful for a reviewer such as myself with minimal history with this fishery. Brief ecological context on the main predators and prey of scallop may have been helpful. I did have some difficulties with the assessments of some of the smaller more marginal areas where issues related to data continuity and extent do still exist; these must be addressed if at all possible to alleviate future ambiguities in assessment and provision of advice.

Region-Specific Comments

I found the depth and scope of the scientific analysis and evaluation of the Bay of Fundy scallops to be quite comprehensive, especially in SPAs 3 to 5.

Differences in growth rates were observed between June vs August in SPA 4. A description of how these differences were accounted for in the population model would have been helpful. I believe the decision rule based upon a much lower p-value (<0.1 ?) may be a more precautionary level of scientific advice. Certainly more thought needs to be focused upon this issue. Nonetheless, it is appreciated that the level of risk is somehow being expressed, something that is giant leap forward in assessment approach as far as I am concerned.

I had a difficult time understanding the uncertainties associated with the analyses of SPA 6. These ambiguities precluded the provision of clear advice for industry and managers. These uncertainties in data, design and analysis must be addressed for the next cycle of assessments. The advice on how SPA 1 TACs should be shared among sub-areas made it amply evident that the management units are too small and that management units should follow biological units wherever possible.

Research Recommendations

1. The insight into the scallop population is quite impressive. However, indicators of variations in important "external" factors may be useful both directly for the assessment as well as providing for a wider "ecosystem" context of the variations in scallop abundance. The primary such indicators include:
    - predators fields from by-catch from research trawls
    - temperature conditions (bottom and top)
    - productivity variations (phytoplanktonic) both in timing and magnitude
    - bottom habitat information
    - monitoring variogram structure (especially on a log-normal scale) can be a sensitive indicator of changes in the distributional structure of scallops, especially when adjusted for environmental factors (a possibility that Stephen Smith has already demonstrated for snow crab)

2. Maps of catch rates and landings may be useful in the analysis of fishery performance and trends and some simple geo-statistics (e.g., variograms).

3. As the level of commercial activity is quite large using similar sampling techniques, it may be useful to add fishery CPUE information directly into the biomass estimation procedure.

4. The exploration of geostatistical methods (universal kriging with external drift in the form of habitat type, CPUE and depth) and to estimate biomass may be useful with this species due to the more sedentary nature of the species and their strong habitat preferences.

5. The possibility of monitoring background mortality rates (clappers) as an indicator of over- or under-exploitation may be a useful direction of study. While it has been indicated that a background mortality of 3-4% is an acceptable level in a species with longevity of potentially 18 years, the actual age distributions are truncated by at least 1/2 and the actual ages at which they are being monitored decreases even further the effective longevity of the species to a much smaller number still.

6. It would be prudent to carefully examine how the PDF of the final abundance estimates are carried forward from their various sources by scientists that understand the approach.

Overall, I congratulate the BOF scallop assessment group for a developing an extraordinarily informative and trend-setting approach to assessment and monitoring of such a forward-thinking and proactive fishery.

ADDITIONAL STAKEHOLDER PERSPECTIVES

Stakeholders present at the meeting identified additional perspectives that did not appear in the Stock Assessment Report that they would like to have considered in the provision of advice for this fishery.

- Documents for RAP meeting need to be distributed to industry in timely fashion for input into SAR document.

- Dockside monitoring must be 100 percent for all fleets to have better accounting of landings, etc., to support scientific evaluation of stocks.

- RAP presentations need to be standardized.

- CSAS Science Advisory Report document should be organized by SPAs.

APPENDIX 1. LIST OF PARTICIPANTS
[Area code = 902 unless otherwise indicated]

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APPENDIX 2. INVITATION LETTER

Maritimes Region, Science Branch
Bedford Institute of Oceanography
P.O. Box 1006, Dartmouth
Nova Scotia, B2Y 4A2
(TEL: 902 426-7444)
(FAX: 902 426-1862)

17 November 2005

Distribution

Subject: Stock Assessment Update of SPA 1, 3, 4, 5, and 6 Scallop Stocks

The stock assessment update of the inshore Bay of scallop stocks will be reviewed in the Park Place Hotel & Conference Centre (Ramada Plaza), 240 Brownlow Avenue, Dartmouth, Nova Scotia, during 24-25 November 2005, commencing at 9:00 am. The meeting's terms of reference are attached.

The purpose of the review is to consider the assessments' data inputs, to examine the scientific approaches of the stock assessments, to identify any weaknesses in data and/or methodology, to help improve the clarity of the assessments, and to make recommendations for further research. It will include a detailed examination of the stock assessments and writing of Science Advice Reports.

Copies of the assessments and the draft stock status reports will be sent to participants one week before the meeting. At the meeting, DFO science staff will provide a brief overview of the assessments, which will include the main conclusions, the supporting evidence, any new methods, and major limitations. The presentation will be followed by discussion among the participants. The finalised stock status report will be prepared at the meeting. The minutes of this meeting will be published as a proceedings.

Région des Maritimes, Direction des sciences
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Le 17 novembre 2005

Liste de diffusion

Objet : Mise à jour des évaluations des stocks de pétoncle des APP 1, 3, 4, 5 et 6

La mise à jour des évaluations des stocks de pétoncle des eaux côtières de la baie de Fundy fera l'objet d'un examen dans la salle de conférences du Park Place Hotel & Conference Centre (Ramada Plaza), 240, avenue Brownlow, Dartmouth (Nouvelle-Écosse) les 24 et 25 novembre 2005, à partir de 9 h. Le cadre de référence de la réunion est joint à la présente.

La réunion aura pour but d'examiner les données d'entrée des évaluations de stock et les approches scientifiques de ces évaluations, de mettre en évidence toute faiblesse dans les données et/ou la méthodologie, d'améliorer la clarté des évaluations et de formuler des recommandations de recherches futures. Elle comprendra un examen détaillé des évaluations de stock et la rédaction des Avis scientifique.

Des copies des évaluations et des ébauches de Rapports sur l'état des stocks seront envoyées aux participants une semaine à l'avance. À la réunion, les scientifiques du MPO présenteront un bref aperçu des évaluations, portant sur les principales conclusions, les preuves à l'appui de ces dernières, toute nouvelle méthode et les principales limites. La présentation sera suivie d'une discussion entre les participants. La version définitive des Rapports sur l'état des stocks sera établie à la réunion et le procès-verbal de cette dernière sera publié sous forme de compte rendu.

I would appreciate if you could confirm your attendance with Daisy Williams at (902) 426-3573 (WilliamsDM@mar.dfo-mpo.gc.ca).

We greatly appreciate your contribution to this valuable exercise.

Je sous serais reconnaissant de bien vouloir confirmer votre présence en communiquant avec Daisy Williams, au (902) 426-3573 (WilliamsDM@mar.dfo-mpo.gc.ca).

Nous vous sommes très reconnaissants de votre contribution à cette importante activité.

Original signed by / Signataire de l'original

Ross Claytor
Meeting chair /Président de la réunion

Attachment / Pièce jointe

cc : RAP Coordination Committee
D. Williams

Distribution / Diffusion

Science / Sciences

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Dale Roddick
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Ralph Brown

First Nations/

Acadia - Curtis Falls
Eskasoni - Blair Bernard
Millbrook - Adrian Gloade
Membertou - Lance Paul
Indian Brook - John Ameriault
Tobique - David Boliver
NBAPC - Jason Harquil
St. Mary's - Candice Paul/Gina Brooks
Woodstock - Chief Jeff Tomah
Oromocto - Mike Power
Kingsclear - Patrick Polchies
Annapolis - Holly MacDonald

APPENDIX 3. MEETING REMIT

REMIT

Meeting of the Maritime Provinces Regional Advisory Process on SPA 1, 3,4, 5 and 6 Scallop Stocks

24 and 25 November 2005

Park Place Hotel & Conference Centre
(Ramada Plaza)
240 Brownlow Avenue
Dartmouth, Nova Scotia

Area 1 Scallop

- Assess the status of Area 1 scallop. The assessment should include:
  - An analysis of available commercial and survey information since 1981
  - Application of the assessment model used CSAS research document 2003/010.
- Review advice provided for the 8–16 mile Digby area for Full Bay fleet and provide advice for rest of area for the 2005/2006 fishery.
- Produce a section of the Inshore Scallop Science Advisory Report documenting the results of the assessment.

Area 3 Scallop

- Assess the status of Area 3 scallop. The assessment should include:
  - An analysis of available commercial and survey information.
- Provide updated advice for the 2006 fishery.

DEMANDE DE RENVOI À LA RÉUNION

du Processus consultatif régional des provinces Maritimes sur les stocks de pétoncle des APP 1, 3, 4, 5 et 6

Les 24 et 25 novembre 2005

Park Place Hotel & Conference Centre
(Ramada Plaza)
240, avenue Brownlow
Dartmouth (Nouvelle-Écosse)

Stock de pétoncle de l'aire de production 1

- Évaluer l'état du stock de pétoncle de l'aire de production 1, ce qui devrait comprendre :
  - Une analyse des données de la pêche commerciale et des relevés disponibles depuis 1981.
  - L'application du modèle d'évaluation utilisé dans le document de recherche du SCCS 2003/10.
- Examiner l'avis formulé au sujet de la zone de 8-16 milles de Digby pour la flottille de la totalité de la baie et formuler un avis en ce qui concerne le reste de l'aire de production pour la pêche de 2005-2006
- Produire une section de l'Avis scientifique sur le pétoncle des eaux côtières documentant les résultats de l'évaluation.

Stock de pétoncle de l'aire de production 3

- Évaluer l'état du stock de pétoncle de l'aire de production 3, ce qui devrait comprendre :
  - Une analyse des données de la pêche commerciale et des relevés disponibles.
- Formuler un avis actualisé pour la pêche de 2006.

- Produce a section of the Inshore Scallop Science Advisory Report documenting the results of the assessment.

Area 4 Scallop

- Assess the status of Area 4 scallop. The assessment should include:
  - An analysis of available commercial and survey information
  - Application of the assessment model used in CSAS research document 2003/010
- Review advice provided for the 2005/2006 fishery.
- Produce a section of the Inshore Scallop Science Advisory Report documenting the results of the assessment.

Area 5 Scallop

- Assess the status of Area 5 scallop. The assessment should include:
  - An analysis of available commercial and survey information
- Provide advice for the 2006 fishery.
- Produce a section of the Inshore Scallop Science Advisory Report documenting the results of the assessment.

Area 6 Scallop

- Assess the status of Area 6 scallop. The assessment should include:
  - An analysis of available commercial and survey information since 1997.
- Provide advice for the 2006 fishery.

- Produire une section de l'Avis scientifique sur le pétoncle des eaux côtières documentant les résultats de l'évaluation.

Stock de pétoncle de l'aire de production 4

- Évaluer l'état du stock de pétoncle de l'aire de production 4, ce qui devrait comprendre :
  - Une analyse des données de la pêche commerciale et des relevés disponibles.
  - L'application du modèle d'évaluation utilisé dans le document de recherche du SCCS 2003/10.
- Examiner l'avis formulé pour la pêche de 2005-2006.
- Produire une section de l'Avis scientifique sur le pétoncle des eaux côtières documentant les résultats de l'évaluation.

Stock de pétoncle de l'aire de production 5

- Évaluer l'état du stock de pétoncle de l'aire de production 5, ce qui devrait comprendre :
  - Une analyse des données de la pêche commerciale et des relevés disponibles.
- Formuler un avis pour la pêche de 2006.
- Produire une section de l'Avis scientifique sur le pétoncle des eaux côtières documentant les résultats de l'évaluation.

Stock de pétoncle de l'aire de production 6

- Évaluer l'état du stock de pétoncle de l'aire de production 6, ce qui devrait comprendre :
  - Une analyse des données de la pêche commerciale et des relevés disponibles depuis 1997.
- Formuler un avis pour la pêche de 2006.

- Produce a section of the Inshore Scallop Science Advisory Report documenting the results of the assessment.

Decision Rule Discussion

- The difficulty of providing scientific advice in terms of the setting of TACs without having decision rules and reference points has been identified as a serious issue in previous Stock Status Reports for these management areas. Time will be allocated during this meeting to discuss candidates for these rules and reference points.

- Produire une section de l'Avis scientifique sur le pétoncle des eaux côtières documentant les résultats de l'évaluation.

Discussion sur les règles décisionnelles

La difficulté qu'il y a à formuler un avis scientifique sur l'établissement de TAC en l'absence de règles décisionnelles et de points de référence est un important problème, qui a été signalé dans les précédents Rapports sur l'état des stocks des zones de gestion considérées ici. On consacrera donc une partie de la réunion à une discussion sur les règles décisionnelles et les points de référence possibles.